the ECPGR Potato WG
a short retrospective

R. Hoekstra, 20240319

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Centre for Genetic Resources, the Netherlands

Request for support GBs -> GENRES projects

Directorate-General Research & Innovation -> no

Directorate-General for Agriculture (DG6)-> yes (small budget)

Council Regulation (EC)

- No 1467/94 - Community programme 1994-1999
  - on the conservation, characterization, collection and utilization of genetic resources in agriculture
  - https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31994R1467:EN:HTML
  - incl. **CT95 – 34/35** (= merger of two potato proposals)
- No 870/2004 - Community programme 2004-2006
  - repealing Regulation (EC) No 1467/94
  - https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32004R0870

EU GENRES project – CT95 – 34/35

Genetic Resources of Potato **including** conservation, characterization and utilization of secondary potato varieties for ecological production systems in Europe

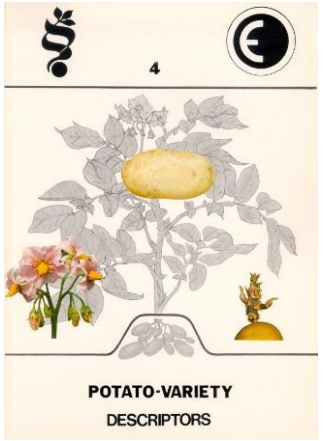
- March 1996 – 2000 (incl. budget neutral extension of 1 year)
  - 12 participants and 5 ECPGR sponsored ones
  - budget: 642.666 € (EU share: 62%)
  - https://ecpgr.cgn.wur.nl/eupotato/general.htm

- 12 project partners from 6 EU countries

- 5 ECP/GR supported partners from Eastern Europe

CT95 -34/35 objectives & results

- establish central databases -> ECPD, EWPD
- improve health status
  - 771 virus cleaned clones
  - 1220 regenerated acc. (EU availability 13% → 30%)
- Phenotypic characterisation
  - new data on varieties: 2700
  - on farm characterisation: 88 clones x 40 traits
  - new data on wild species: 2000
- rationalisation of collections
  - duplicates identified
  - 295 clones cryo preserved



European Cultivated Potato Database encountered difficulties

- descriptor interpretation
  - donor country misused for country of origin
- anomalies in spelling

  Priekulskii Rannii, Priekulskij Rannij, Priekulsky Ranny
- different parentages for same variety name (e.g. Gloria)

  complication: a variety like Gloria without parentage

ACCNAME	PARENTAGE	LISTING	ORIGCTY	INSTCODE
Gloria	Amex x Feldeslohn	1972	DEU	POL IPR BON
Gloria (1972)	Amex x Feldeslohn (adg)	1972	DEU	DEU416
Gloria (1972)	Amex x Feldeslohn (adg)		DEU	CZEHBROD
Gloria	Amex x Feldeslohn			NIVAA-RL99
Gloria	Amex x Feldeslohn			NIVAA-NLCat00
Gloria (1937)	Alpha x Bato	1937	NLD	DEU416
Gloria	Alpha x Bato	1937	NLD	POL IPR BON
Gloria	Alpha x Bato		NLD	NEIKER
Gloria	L_race from Bogsta x Unica	1921	SWE	SWE002
Gloria **(FRA179)**				FRA179
Gloria **(GBR165)**			NLD	GBR165

ECPD result

- ECPD database: 11765 records of
  - over 4000 different varieties & 1400 breeding lines
- Online in Nov. 2001 www.europotato.org

ECPD is the result of collaboration between participants in 8 European Union countries and 5 East European Countries and is intended to be a source of information on varieties maintained by them. Within the database all observations are attributed to their source.

The Database will be maintained and updated by SASA within the framework of the European Cooperative Programme for Plant Genetic Resources (ECPGR) which is coordinated by Bioversity International. ECPGR is a collaborative programme among most European countries aimed at ensuring the long-term conservation and facilitating the increased utilization of plant genetic resources in Europe.

EWildPD: identification of redundancy

Collector codes with including Prof. Hawkes:

- **HAW**, HAH, HHC, HHCH, HHLS, HHR, HHRO, HOHH, HVHL

Collector no.	SPP	CNT	CGN	VIR	CPC	PI
HOHH 6034	OKA	ARG	961924			
HAW 6034	OKA	ARG			7129	
OKA 5645	VNT	ARG		17177&17516		
OKA 5645	OKA	ARG		20170		458368

COLLNU_IPD	COLLNUMB	INSTCODE	ACCENUMB	SPP	SPECIES	SUBTAXA	ORIGCTY	STATE
HOHH 6079	OKA 5690	RUS001	VIR 17480	SPG	spegazzinii		ARG	
HOHH 6079	HOHH 6079	NLD037	CGN 18100	SPG	spegazzinii		ARG	P. Tucuman

wild & cultivated spp.

Prob. duplication between/within Eur. genebanks (2005)

	CGN	CPC	CZE	IPK	VIR	total
no. acc.	2714	1483	63	2928	5321	11749
CGN	4					
CPC	207	117				
CZE	37	7				
IPK	439	385	11	89		
VIR	747	323	20	403	723	
% unique in Europe	61	49	38	68	66	67 (7915)

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EWPD result

- 10323 records in Eur. Wild Potato Database
- downloadable since 2000:

  https://ecpgr.cgn.wur.nl/eupotato/general.htm

the European Wild Potato Database

The maintenance of the European Wild Potato Database (EWPD), which also includes native Andean varieties, is carried out in the framework of the activities of the ECPGR Potato Working Group. A major update of this database, identifying in particular additional redundant accessions within and between collections has been executed.

The duplicates can be found by sorting the field COLLNU_IPD .

January 2006 the length of GLKS accessions numbers from IPK was increased to five (mostly by adding the value 30000).

In the current version only wild spp. of VIR are included, because the records of cultivated spp. still undergo a major update. For wild spp. at VIR this process has been finalised.

The current members of the the ECPGR Potato Working Group are listed at:
http://www.ecpgr.cgiar.org/working_groups/potato.html

The database on European varieties (ECPD) is maintained by SASA at: http://www.europotato.org

- Final meeting of CT95- 34/35 also startup meeting of ECPGR Potato WG

Wageningen, December 27, 2016.
R. Hoekstra

Follow up: ECPGR Potato Working Group

- www.ecpgr.cgiar.org/working-groups/potato
- In first 10 years minor activities
  - mainly updating of ECPD & EWPD
- June 2011 – Dec. 2012 AEGIS Potato project
  - Under Phase VII ECPGR Activity Grant Scheme (10k€)
  - additional Potato WG allocated funds: 16.8k€

- RH ended being chair of the Potato WG in 2014

AEGIS - virtual European PGR collection

- In particular old potato cultivars can be mislabelled
- Some variety names have been used more than once (e.g. Gloria 1921, 1937, 1972). True identity not always known
    - hampering the selection of the Most Appropriate Accessions (MAA's) for the AEGIS collection
- To assist in granting Plant Breeders' Rights for potato, a standard fingerprinting method was developed (Reid *et al*. 2009, 2011)
    - It will be used in the project to genotype old varieties to assist in setting up the AEGIS collection for potato.

Criteria for the material selection

- only varieties that has been put into the MLS, therefore excluding FRA, ESP & ITA in 2011 (23k -> 4161 acc.)
- UK collection initially skipped under assumption that it already was fingerprinted by SASA
- only old varieties <=1960, or more modern varieties with the same name as an elder clone (e.g. Apollo)
- samples from country of origin preferred
    - Odd situation: country of origin (e.g. ITA) does not put an old Italian variety into the MLS, whereas a genebank in another country (e.g. DEU) does
- preferably heritage varieties that have not been profiled by SASA before

proposed & realized material selection

1	INSTcode	description	selectedACC	contact1
2	CHE001	Station de recherche Agroscope Changins-Wädenswi	10	Eric Droz
3	CZE027	Potato Research Institute Havlickuv Brod Ltd., Dobrov	40	Ms. Jaroslava Domkárová
4	DEU159	IPK, Parkweg 3a, 18190 Gross Lüsewitz, Germany (as v	308	Klaus Dehmer
5	EST006	Estonian Res. Inst. of Agriculture, Teaduse 6a, Saku, 7	4	Ms Katrin Kotkas
6	IRL012	Department of Agriculture Food and Forestry, The Tc	41	Gerry Doherty
7	LVA006	Priekuli State Plant Breeding Station, Zinatnes Str. 1a	2	Ms Ilze Skrabule
8	SWE054	Nordic Gene Bank, P.O. Box 41, S - 23053 Alnarp, Swe	36	Svein Solberg
9		total	441	

Table 2. Number of accessions submitted by each country analysed in this study.

Country of submission	Number of accessions
Czech Republic	39
France	28
Germany	136
Latvia	2
Sweden	34
Switzerland	25
Estonia (material provided by Ukraine)	4
Ireland	0 (+ 30 donated fingerprints)
United Kingdom	111 (+ 24 donated fingerprints)

in total 433 acc. included in the study

used 12 SSRs

Table 1. Marker information showing the repeat motif of the microsatellite, linkage group (or chromosome) and original reference.

Multiplex set	Marker name	Repeat motif	LG	Reference
1	STMS 0019	$(AT)_7$ $(GT)_{10}$ $(AT)_4$ $(GT)_5$ $(GC)_4$ $(GT)_4$	VI	Milbourne *et al.*, 1998
	STMS 3009	$(TC)_{13}$	VII	Milbourne *et al.*, 1998
	SSR1	$(TCAC)_n$	VIII	Kawchuk *et al.*, 1996
2	STMS 2005	$(CTGTTG)_3$	XI	Milbourne *et al.*, 1998
	STMS 3012	$(CT)_4.(CT)_8$	IX	Milbourne *et al.*, 1998
	STMS 3023	$(GA)_9.(GA)_8.(GA)_4$	IV	Milbourne *et al.*, 1998
3	STMS 2028	$(TAC)_5.(TA)_3.(CAT)_3$	XII	Milbourne *et al.*, 1998
	STMS 5136	$(AGA)_5$	I	Ghislain *et al.*, 2004
	STMS 5148	$(GAA)_{17}$	V	Ghislain *et al.*, 2004
4	STMS 1016	$(TCT)_9$	VIII	Milbourne *et al.*, 1998
	STMS 1024	$(TTG)_6$	VIII	Milbourne *et al.*, 1998
	STMS 2022	$(CAA)_3..(CAA)_3$	II	Milbourne *et al.*, 1998

Allele frequencies of 95+31 rare alleles

Total allele frequencies (%) — 7085 clones

Allele/SSR	0019	1016	1024	2005	2022	2028	3009	3012	3023	5136	5148	SSR1
A	1.7	0.05	1.5	24.2	0.04	37.1	0.21	0.8	37.4	0.2	2.7	9.3
B	26.8	0.1	7.1	31.3	29.2	16.9	16.5	47.7	22.8	0.5	8.9	2.7
C	0.3	3.9	44.7	0.6	2.1	32.3	1.8	18.5	3.8	16.2	1.3	3.2
D	10.6	28.4	7.8	31.6	1.9	1.8	5.1	15.8	36	7.8	0.04	28.1
E	2	1.1	30.5	0.23	58.4	5	0.66	1.6		27.4	1.6	3.1
F	37.4	3.3	0.26	12.1	0.04	3.9	25.5	15.3		30.3	2.4	16.7
G	19.1	19.2	8.1		8.4	2.6	48.3	0.3		0.24	4.3	2
H	1.5	6.7	0.04			0.18	0.17			17.1	0.02	0.15
I	0.5	0.18				0.21	0.7			0.25	16.1	29.4
J	0.05	0.5					0.5			0.04	25.5	2.8
K		0.13					0.4			0.01	0.2	0.5
L		27.7					0.14				1.2	1.8
M		8.6					0.05				4	0.02
N		0.02					0.01				1.7	0.15
O		0.09									17.9	
P		0.05									11.8	
Q											0.19	
R											0.07	
S											0.02	
T											0.03	

allele not in AEGIS study

Results

- Allelic data for 12 SSR markers on 433 clones
- Profiles compared within AEGIS set + SASA database
- The 433 accessions show 397 different profiles
- The 27 duplication groups contain 2 till 6 acc.
- The largest group consists of blue coloured varieties
- For Fortuna / Morgane_1985 it is unclear which one has been mislabelled

https://ecpgr.cgn.wur.nl/aegis/AEGISpotato/

Clones with identical profiles

Table 1. Clones with identical profiles for 12 SSRs

Key	Variety denomination	sample	profile
AEG-10381	Flaminia	DEU	12
AEG-0056	Flaminia	FRA	12
AEG-0033	Monika	CZE	50
AEG-0034	Monika	CZE	50
AEG-12139	Adelheid	DEU	67
AEG-10522	Oberambacher_Adelheid	DEU	67
06/308	Aura	GBR	80
AEG-0046	Aura	FRA	80
DAFF-C-146	Tecka	IRL	90
AEG-10452	Wekaragis	DEU	90
AEG-10775-1	Atlas_(1960)	DEU	107
AEG-10775-2	Atlas_(1960)	DEU	107
08/062	Centrifolia	GBR	110
AEG-P067	Rosafolia	CHE	110
AEG-0215	Arran_Cairn	GBR	182
AEG-11264	Arran_Cairn	DEU	182
AEG-10437	Regent_(NLD)	DEU	184
AEG-0037	Regent	CZE	184
13/613	Early_Rose	GBR	214
13/616	Puritan	GBR	214
AEG-P017	Blaue_Schweden	CHE	238
AEG-0080	Congo	SWE	238
AEG-12436	Orion_(Schots)	DEU	247
AEG-0192	Orion	GBR	247
AEG-11462	Gabi_(1989)	DEU	252
AEG-0021	Gabi	CZE	252
AEG-P062	Allerfrüheste_Gelbe	CHE	267
DAFF-T-047	Prevalent	IRL	267
AEG-0019	Fortuna	CZE	269
AEG-0072	Morgane_1985	FRA	269
AEG-10784	Anna_(1947)	DEU	289
AEG-0008	Anna	CZE	289
AEG-0172	Shetland	GBR	301
AEG-0238	Ryecroft_Purple	GBR	301
DAFF-J-061	Tinwald	IRL	326
AEG-0196	Tinwald_Perfection	GBR	326
AEG-0107	Rödbrokig_svensk	SWE	336
AEG-0243	Peachbloom	GBR	336
08/028	Red_Ulster_Premier	GBR	356
08/029	Ulster_Premier	GBR	356
AEG-0211	Bishop	GBR	365
AEG-12256	Bishop	DEU	365
AEG-0170	Eigenheimer	GBR	372
AEG-P024	Tennaer	CHE	372
AEG-12145	Blauwe_Eigenheimer	DEU	372
AEG-10225	Astra_(1983)	DEU	385
AEG-0044	Astra	LVA	385
AEG-0240	Robijn	GBR	137
AEG-P028	Lauterbrunnen	CHE	137
AEG-10606	Robijn	DEU	137
AEG-10845	Flora_(1955)	DEU	340
AEG-0017	Flora	CZE	340
AEG-0018	Flora	CZE	340
AEG-0086	Karjalan_Musta	SWE	359
AEG-12037	Skerry_Blue	DEU	359
AEG-0048	Bleue_dAuvergne	FRA	359
AEG-P053	Blaue_Österreich	CHE	359
AEG-P026	Vitelotte	CHE	394
AEG-12317	Vitelotte	DEU	394
AEG-0073	Vitelotte_Noire	FRA	394
AEG-0040	Unbekannte_Schwarze	CZE	394
AEG-P025	Blaue_Veltlin	CHE	394
AEG-0209	Blue_Peter	GBR	394
DAFF-J-136	Tombola	IRL	195
	Tuskar	GBR	
DAFF-J-085	Arka	IRL	390
	Red Kidney	GBR	

Selection of not matching clones

Key	Variety denomination	sample	0019	1016	1024	2005	2022	2028	3009	3012	3023	5136	5148	SSR1	profile
AEG-P073	Alma	CHE	BF	CDGL	CE	AB	E	AC	FG	BD	ABD	DEFH	BIJ	CDFI	79
AEG-0006	Alma	CZE	BG	DGHL	CE	AB	E	ACE	FG	B	AD	EFH	BO	DFI	186
AEG-12682	Alma_(?)	DEU	BEG	DGL	CE	ABD	BE	A	FG	BC	AD	EF	JOP	DFI	68
AEG-0009	Astra	CZE	F	DL	CEG	ABD	BE	AB	F	BCF	AD	EFH	ANP	DI	304
AEG-0044	Astra	LVA	G	DG	CE	ABD	E	ABF	BFG	BD	D	AF	BJOR	FK	385
AEG-10225	Astra_(1983)	DEU	G	DG	CE	ABD	E	ABF	BFG	BD	D	AF	BJOR	FK	385
AEG-0010	Athene	CZE	BG	CDL	CE	AB	E	AC	FG	B	AD	EF	BIO	CDI	180
AEG-10543	Athene_(1964)	DEU	BEG	DGLM	CE	ABD	BEG	AC	FG	BCD	AD	EF	JOP	ADFI	70
13/613	Early_Rose	GBR	DF	DGL	CE	ABD	BE	AC	BG	BCF	AB	EFH	UP	DFI	214
AEG-P035	Early_Rose	CHE	DG	DGL	CD	ABD	BE	ACE	FG	BC	ABD	DEH	BJOP	DFI	244
AEG-0017	Flora	CZE	FG	DGLM	CE	ADF	E	ACD	FG	BC	AD	DFH	NOPR	ADFK	340
AEG-0018	Flora	CZE	FG	DGLM	CE	ADF	E	ACD	FG	BC	AD	DFH	NOPR	ADFK	340
AEG-10837	Flora_(1939)	DEU	BD	DG	CDG	ABD	BE	AC	FG	BCF	AD	DEF	IJO	FI	21
AEG-10845	Flora_(1955)	DEU	FG	DGLM	CE	ADF	E	ACD	FG	BC	AD	DFH	NOPR	ADFK	340
AEG-0183	Iris	GBR	FG	DHL	C	DF	BE	ABC	G	BDF	AD	EFH	JO	DI	349
AEG-11515	Iris	DEU	FG	L	CE	ABF	E	AC	FG	BF	ABD	CEF	IJO	AD	380
AEG-10372	Luna_(1954)	DEU	BDF	DGL	CE	B	E	C	FGK	BCF	D	EF	NO	DFI	39
AEG-12669	Luna_(1998)	DEU	G	DL	CE	AB	E	AC	F	BCDF	AD	EF	EJO	DI	391
AEG-0060	Morgane_1955	FRA	DF	DM	CG	BD	BE	ABC	FG	BC	A	DEFH	JMP	AI	222
AEG-0072	Morgane_1985	FRA	F	DGL	C	ABD	E	AC	BFG	BC	D	CFH	JOP	DFI	270
AEG-0062	Orion	FRA	DF	DHL	CE	B	BE	ACDE	FG	CDF	D	EF	ABO	DI	218
AEG-0192	Orion	GBR	DGH	DL	C	BF	E	AF	BG	B	BD	DF	INP	DI	247
AEG-12436	Orion_(Schots)	DEU	DGH	DL	C	BF	E	AF	BG	B	BD	DF	INP	DI	247
AEG-10829	Palma_(1951)	DEU	BEF	DG	CDE	ADF	BEG	AC	FG	BF	AD	DFH	IJO	FI	65
AEG-11717	Palma_(1972)	DEU	BDF	DG	CE	BD	E	AC	G	BCF	AD	EF	JO	FI	35
AEG-10375	Petra_(1958)	DEU	DG	DGHL	CE	BD	BE	AE	DFG	BDF	D	EFH	BJO	DFI	243
AEG-12439	Petra_(1991)	DEU	F	DGM	CD	ABD	E	ACD	FG	BC	BD	FH	BIOS	DFI	279
DAFF-J-054	Reina	IRL	BF	DL	CE	ABF	E	ABC	FG	B	AD	EFH	IO	DI	132
DAFF-C-118	Rejina	IRL	F	DLM	CG	AD	E	B	FG	BC	AD	CDE	JO	ADI	308
AEG-10030	Sefton_Wonder	DEU	B	DGL	CE	AB	E	ACE	BFG	B	AD	CEF	EJOP	DFI	8
AEG-0200	Sefton_Wonder	GBR	F	DH	C	BF	BE	A	BFG	BF	AD	CEF	IJ	I	281
AEG-0172	Shetland	GBR	F	DL	C	BF	BEG	AC	BFG	BF	ABD	CDEF	IJO	DI	301
AEG-0173	Shetland_Black	GBR	BFG	DL	CD	DF	BE	AC	B	BDF	AB	DEF	AJMP	DI	167
AEG-0197	Ulster_Concord	GBR	F	DGL	C	ABD	E	A	G	B	ABD	EF	JNOP	DFI	268
DAFF-J-139	Ulster_Concord	IRL	FG	DL	CG	BF	E	A	BG	BCDF	ABD	EH	JOP	DI	367
	Matches UK and Ireland Ulster Dale and Ulster Glade (Teagasc)														
DAFF-J-135	Thynia	IRL	DG	DGH	CE	ABD	BE	AC	G	BC	ABD	EFH	BIJ	FI	242
	Does not match UK Thynia														
DAFF-J-134	The_Baron	IRL	FG	DG	CE	AB	E	ACD	FG	BC	D	CEFH	BEIJ	FI	331
	Does not match UK The Baron, but UK Thynia. UK The Baron matches Millar's Beauty & Symfonia from IRL. (Another Irish sample labelled as Sprint matches Symfonia from UK & NLD.)														

Discussion (2012) 1

- Sometimes unclear which country/collection will put a cultivar into the AEGIS collection
  - E.g. when origin country did not put their accessions into the MLS (ITA, ESP, FRA)
  - The ECPGR Secretariat (J. Engels) suggested to include 'reserve accessions' and to replace these at a later stage when the country of origin includes those accessions in the European Collection.
    - At 3 March 2014 Italy joined AEGIS and presumably will include Italian potato varieties in AEGIS

Discussion (2012) 2

- Several collection holders are fingerprinting their clones with SSRs, mostly with a deviant set of markers, which may be caused by the suitability of the marker/equipment combination
  - Redundancy within the collection will be identified
  - Comparison of profiles between different studies is only possible for identical markers
    - A comparison with profiles produced in other countries is lacking, apart from FRA & CHE and UK & NLD
  - An international comparison would provide important additional information for AEGIS
  - Harmonisation can be achieved by comparing a standard set of genotypes

Recommendations (2012)

- Varieties that have been given different names in different countries (e.g. Eigenheimer in NLD & Tennaer in CHE) should be recorded as synonyms
- Curators should resolve known mislabeling (e.g. the Congo clone in the UK)
- Efforts should be made to allow comparison of the national fingerprints. All new varieties going through DUS in Europe will be fingerprinted using the 9 markers from the CPVO study (Reid *et al*. 2009 & 2011). Research labs should include at least these 9 markers.
    - CPVO should endorse that it's database on SSR profiles becomes public

May 30 – International Potato Day

Food and Agriculture Organization
@FAO

- 3rd most consumed food crop globally
- 159 countries cultivate it
- 5 000 varieties worldwide
- 8 000 years of story

#InternationalDayOfPotato

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Hermsen & Ramanna utilised *S. bulbocastanum*

Alternative for DMS R-genes

- After 46 years the first resistant cultivars Bionica & Toluca with Rpi-abtp (=Rpi-blb2)

Potato Research (2009) 52:249–264
DOI 10.1007/s11540-009-9136-3

Applied Biotechnology to Combat Late Blight in Potato Caused by *Phytophthora Infestans*

A. J. Haverkort · P. C. Struik · R. G. F. Visser · E. Jacobsen